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Reducing Start-up Costs for New Firms: The Double Dividend on the Labor Market

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Abstract:

We investigate whether there was a causal effect of income changes on the health satisfaction of East and West Germans in the years following reunification. Reunification was completely unanticipated and therefore can be seen as a 'natural experiment', which resulted in a rapid and exogenous rise in household incomes in East Germany but not in West Germany. Our data source is the German Socio-Economic Panel (SOEP) between 1984 and 2002, and we fit a new fixed-effects ordinal estimator to our health measures and develop a new causal decomposition technique to account for panel attrition. We find evidence of a significant positive effect of income changes on health satisfaction, but the quantitative size of this effect is very small. This is the case with respect to current income and a measure of 'permanent' income.

Classification JEL codes: Z1, C23, C25, I31
Keywords: Income, Health, German Reunification, Panel Data, Attrition

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Reducing Start-up Costs for New Firms: The Double Dividend on the Labor Market*

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Abstract

Starting a firm with expansive potential is an option for educated and high-skilled workers. If there are labor market frictions, this additional option can be seen as reducing the chances of ending up in a low-wage job and hence as increasing the incentives for education. In a matching model, we show that reducing the start-up costs for new firms results in higher take-up rates of education. It also gives rise—through a thick-market externality—to higher rates of job creation for high-skilled labor as well as average match productivity. We provide empirical evidence to support our argument.

Keywords: Matching; education; start-up costs; venture capital; bureaucratic hurdles
JEL Classification: *J*24; *D*73; *J*68

I. Introduction

In many countries, the importance of entrepreneurship is gaining more and more attention.[1] The prime arguments in support of creating new businesses concern innovation, the adaptability of economies towards new opportunities, and expansion of the "boundaries of economic activity"; see OECD

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[1] See, for example, Commission of the European Communities (1999) and OECD (1998a,b).

(1998b). Governments and Chambers of Commerce argue that reduced start-up costs for new businesses are a potential cure for the ailing European labor market.

Reductions in start-up costs can take two forms. One is to reduce the bureaucratic hurdles that form part of the start-up costs for new firms.[2] The second is to provide institutions for venture capital as well as public financial support for new firms.[3]

In this paper we study the implications of lower start-up costs in a situation where new firms (at least, those with high productivity) can only be set up by high-skilled persons. Lower start-up costs then affect education choices by improving the options of skilled workers. More workers obtain education and more high-skill firms will be set up, which is the first dividend. The increase in the proportion of workers who are educated triggers, through a search externality, a second dividend: because the odds of getting high-skilled workers to apply for a given vacancy go up, already existing firms create more jobs for high-skilled workers. We provide a model that identifies both these effects.

The current literature on establishing new firms focuses on the firm level and the effects of new firms on existing markets.[4] Our contribution is to endogenize education decisions in this framework. Is there, however, any "prima facie" empirical indication that lower start-up costs are related to educational choices? Figures 1 and 2 indeed show that two separate measures of start-up costs—the number of days it takes to set up a new firm and the availability of start-up financing—correlate with education choices. At the very minimum, these graphs suggest there is some merit in further investigating a positive link between low start-up costs and incentives for high-skilled education.

Our matching model is in the vein of Pissarides (2000) and Fonseca, Lopez-Garcia and Pissarides (2001). In equilibrium, high-skilled workers first search for a high-skilled vacancy in existing firms. Search frictions

[2] Start-up costs are often regarded as entry costs. On example is Blanchard and Giavazzi (2003) who interpret product market deregulation as start-up cost reduction in a general equilibrium model. They study how employment and wages are affected by product and labor market deregulation.

[3] Another aspect of venture capital and its effect on labor markets is discussed theoretically and empirically by Belke, Fehn and Foster (2003). In a matching framework, they argue that the availability of venture capital helps to select better managers.

[4] Much empirical research can be found on these issues. To name two examples: Audretsch, Santarelli and Vivarelli (1999) study industry dynamics and the extent to which the survival of new firms depends on start-up costs and industry characteristics. Gans, Hsu and Stern (2002) consider empirically the effects of start-up costs on trade in ideas, innovation and the founding of new firms in an industry.

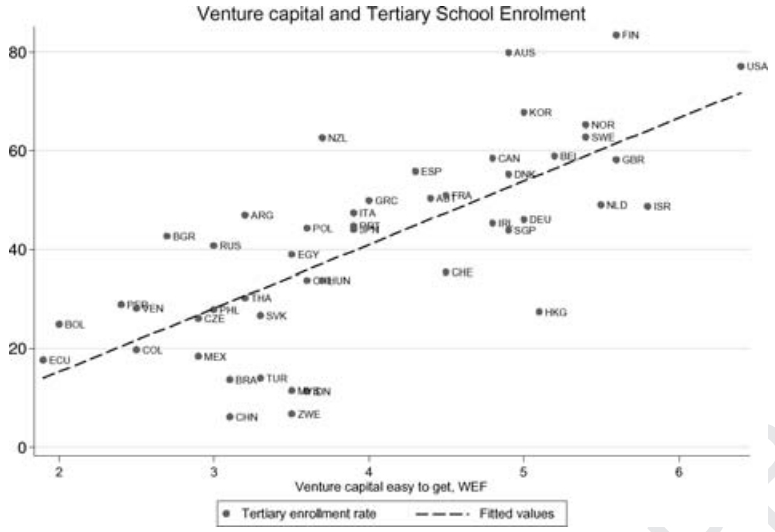

Fig. 1. Venture capital and tertiary school enrollment
Sources: UN World Development Indicators and Porter, Sachs, Warner, Cornelius, Levinson and Schwab (2002).

prevent a perfect match between high-skilled vacancies and high-skilled job seekers. Some high-skilled unemployed then opt for setting up new firms until the value of outside low-skilled employment equalizes the value of creating a new firm. The equilibrium proportion of high-skilled vacancies is then determined by the proportion of high-skilled workers in the pool of unemployed, which links the proportion of high-skilled vacancies with the outside option for high-skilled workers of setting up a new firm. This gives rise to a matching externality: a larger share of high-skilled workers will increase the profitability of posting a high-skill vacancy for existing firms. This increases the number of high-skilled vacancies created when start-up costs for new firms decrease. Through this "thick-market externality", higher education rates lead to more job creation for high-skilled workers, thereby again adding to the incentives to invest in education. Under the specific assumptions of our model, lower start-up costs increase production and reduce the number of workers who fill low-skilled jobs.

Empirical evidence suggests that education does not affect the selection of entrepreneurs but rather their performance; see the survey by Le (1999) and the meta studies by Van der Sluis, Van Praag and Vijvenberg (2003, 2005). Given that the effects on education are at the core of our interest, we accommodate this observation by focusing on start-ups in the high-tech (high-performance) sector, which are only feasible for educated

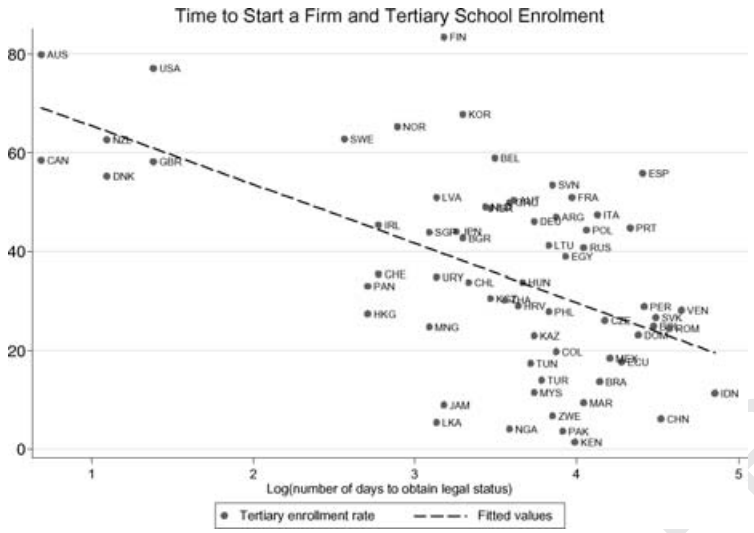

Fig. 2. Time to start a firm and tertiary school enrollment
Sources: UN World Development Indicators and Djankov, La Porta, Lopez-de-Silanes and Shleifer (2002).

(high-skilled) individuals.[5] We abstract from the employment effects of start-up costs on low-skilled labor by assuming that matching is frictionless on the low-skilled market. There are three reasons for doing so: first, it simplifies the analysis; second, it can be interpreted as a situation where unemployed low-skilled workers can always set up a firm (the often observed self-employed street vendors); and third, it simply models the situation where there exists a given expected return once a worker enters the low-skilled labor market.

Closest to our approach are Fonseca *et al.* (2001) and Pissarides (2003) who study the effects of start-up costs in a matching model where workers are heterogeneous with respect to the potential profit of starting a new firm. Both contributions focus on the job-creation effect of start-ups. We focus on the effect on education choices. Although Fonseca *et al.* (2001)

[5] Devine (1994) discusses the development of self-employment over time with a particular emphasis on returns to education. She finds that, for the U.S., self-employment increased the most for workers who faced rising potential earnings in salaried employment over time, which implicitly would mean that earnings potential in the self-employed sector has risen relatively more. The importance of formal education as well as experience might be very diverse across countries due of different regulatory requirements for starting a business; see Luber, Lohmann, Müller and Barbieri (2000).

and Pissarides (2003) do not consider education, they also argue that lower start-up costs lead to the creation of more firms and less unemployment. The effect of reducing start-up costs on the efficiency of the market is ambiguous in their model: if too many workers start new firms, the workforce may become too small and output suffers. In contrast, lower start-up costs are always beneficial for the economy in our model.

A related line of enquiry is the link between education choices and search frictions. Acemoglu (1996) provides the basic intuition: workers decide on their investment in education before knowing whether they will be able to find a high-skilled job. A higher proportion of educated workers then prompts more firms to creat such jobs, thus implying a wedge between private and social returns to education. Burdett and Smith's (2002) "low skill trap" is based on a similar intuition. They provide a model with search frictions in which multiple equilibria exist, where firms offer either too few or too many high-skilled jobs and workers either acquire or refrain from acquiring skills.[6] These papers differ from ours in that search frictions in our model are bounded by the option of setting up one's own firm.

Other policy options that affect the education choice of individuals are considered in the matching literature. Belot (2003) models education choices and migration options under labor market frictions. She argues that policies which increase migration possibilities also increase the incentives to invest in education. Another policy option is unemployment insurance, which effectively reduces the importance of unemployment risks and hence stimulates the unemployed to look for higher-paying riskier jobs. Acemoglu and Shimer (1999) show that unemployment insurance can thus be output increasing when the unemployed are risk averse. When the possibility of taking a risky job is related to particular education choices, unemployment benefits affect education choices.

Our baseline model in Section II captures the basic search-friction argument. In Section III, the baseline model is extended by introducing the opportunity for high-skilled persons to start a new firm. We discuss and interpret the comparative statics of the model. Section IV contains empirical evidence that supports the main prediction of our model: the positive effect of start-up costs on skill acquisition. Section V concludes.

[6] Masters (1998) studies the differences between wage bargaining and fixed rent-sharing agreements in a model with investment in capital by firms and investment in education by workers. He finds that inefficiencies in the market have to be attributed to both search frictions and inefficiencies in the determination of wages.

II. A Matching Model with Education

The Basic Model

The economy consists of a fixed large number of firms and N workers. We consider a matching model with two time periods. In period one the workers in the economy decide whether to enroll in education and firms choose the number of vacancies for high- and low-skilled jobs. In the second period, firms and workers are matched and production takes place.

With respect to the cost of education, workers have an innate ability $\theta \in [0; 1]$. Ability is distributed across the population following a continuous cumulative distribution function $Q(\theta)$ on the support of [0, 1]. Workers who choose to invest in education incur a cost of $e(\theta)$. By assumption, higher ability individuals have lower costs of education, i.e., $de(\theta)/d\theta < 0$. To guarantee an interior solution we assume that education is costless to the most gifted person ($e(1) = 0$) and impossible to achieve for the least gifted ($e(0) = \infty$). In all subsequent arguments, this will lead to a cut-off ability z above which workers become educated and below which they do not. Then, $1 - Q(z)$ is the share of workers becoming educated.[7]

Firms can offer two types of jobs: low-skilled jobs and high-skilled jobs. Posting a low- (high-)skilled vacancy imposes costs of $c_l(c_h)$ on the firm. We denote the overall number of vacancies as V_l and V_h. Low-skilled jobs can be performed by any type of worker whereas high-skilled jobs can only be filled by high-educated workers. Matching individuals to high-skilled jobs is by assumption more difficult than matching individuals to low-skilled jobs. For simplicity, we assume frictionless matching on the low-skill labor market, i.e., there is a spot market for low-skilled jobs. The number of low-skilled matches equals $M_l = \min\{N_l ; V_l\}$, where N_l and V_l refer to the number of workers seeking low-skilled jobs and the number of low-skill vacancies, respectively. Think of low-skilled jobs as hamburger-flipping positions which can be found at virtually no cost at all.[8]

With respect to high-skilled jobs we assume that matching frictions are captured by a constant returns to scale matching function $m(N_h, V_h)$. The number of educated workers N_h is equal to $(1 - Q(z))N$. The number of successful high-skilled matches equals $M_h = m((1 - Q(z))N, V_h)$. Unsuccessfully educated workers enter the low-skill labor market, which means

[7] Note that ability is defined here as needing less cost (effort) to acquire skills through education. Acquiring skills itself is in principle open to all, but the choise to invest in the necessary education is endogenous.

[8] Assuming frictions on the market for low-skilled labor do not change the basic story because a higher probability of unemployment merely increases the value of the option to start a new firm. Furthermore, this assumption can be interpreted as reflecting a spot market for the output of the low-skilled self-employed.

we assume that matching takes place first for high-skilled jobs and then for low-skilled jobs. The number of individuals prepared to accept low-skilled jobs thus equals $N - M_h$.

A successful match has productivity p_l, p_h, respectively. We assume that wages in successful matches are determined by instantaneous Nash bargaining where the power of workers is independent of education and equals β: wages are given as $w_l = \beta p_l$ and $w_h = \beta p_h$.[9] To ensure that production takes place we assume $(1 - \beta)p_j > c_j$, $j \in \{l, h\}$. If this did not hold, there would be no low-skilled (high-skilled) workers at work, which is a trivial case.

Analysis of the Basic Model

We start with the behavior of firms with respect to low-skilled jobs. Firms will obviously set up low-skilled vacancies when there is a surplus in doing so. This is the case given the assumption larger productivity: $(p_l - w_l)$ is by assumption larger than c_l. To maximize profits, firms will post vacancies as long as the marginal expected profit is non-negative. This "free entry" condition for low-skilled vacancies implies that the number of posted low-skilled vacancies solves

$$\frac{N - M_h}{V_l}(p_l - w_l) - c_l = 0. \tag{1}$$

The solution is

$$V_l = \frac{N - M_h}{c_l}(p_l - w_l).$$

This must be higher than $N - M_h$ because $p_l - w_l > c_l$, which shows that there is an oversupply of low-skilled vacancies. This is rent dissipation.

The number of individuals who choose to become educated is determined by the condition that the marginal individual is indifferent between becoming highly educated or not. The equation determining z is given as

$$\frac{m((1 - Q(z))N, V_h)}{(1 - Q(z))N}(w_h - e(z)) + \left(1 - \frac{m((1 - Q(z))N, V_h)}{(1 - Q(z))N}\right)(w_l - e(z)) = w_l. \tag{2}$$

[9] To be strict, we assume that bargaining takes place after matches were formed, i.e., once a worker and a firm start bargaining, both lose the option to find another match. In case of disagreement, both receive a payoff of 0.

For the firm, setting up a marginal high-skilled vacancy must have zero profits, which implies

$$\frac{m((1-Q(z))N, V_h)}{V_h}(p_h - w_h) = c_h. \tag{3}$$

The following proposition states the result for the basic model.

Proposition 1. *In the basic model with education and low- and high-skilled jobs there exists a unique equilibrium, described by a set* $\{\tilde{V}_h, \tilde{V}_l, \tilde{z}\}$ *where* $\tilde{V}_h, \tilde{V}_l, \tilde{z}$ *denotes the equilibrium number of high- and low-skilled vacancies and the cut-off ability, respectively.*

Proof: The proof runs via standard arguments: the productivity and the bargaining power uniquely determine V_l. Equations (2) and (3) determine $\tilde{V}_h$ and $\tilde{z}$. Only one solution exists because for a given z, the marginal profit of an extra high-skilled vacancy is monotonically decreasing in V_h. This implies there is only one (finite) level of V_h for any given z. Finally, the value of becoming high skilled is monotonically increasing in θ because of decreasing education costs. Due to the assumptions on $e(\cdot)$, there will be a unique level of z at which an individual is indifferent. This level is $\tilde{z}$. In the simple model we hence have a unique equilibrium set $\{\tilde{V}_h, \tilde{V}_l, \tilde{z}\}$. ■

III. Business Start-ups

Model Extension

We now introduce the possibility for educated workers to start a business. The type of business we have in mind obviously has high productivity. This means that we abstract from "new firms" which are actually a form of low-skilled employment such as street vending. This assumption is empirically supported by the observed link between education and performance of entrepreneurship, indicating that educated entrepreneurs usually enter high-performance/innovative industries.

An individual who sets up his/her own high-skilled production job has to bear the cost SC. We assume that firms are more efficient in setting up such jobs than the unemployed are and that β is large enough such that accepting a high-skilled job in a firm is more attractive to an educated worker than starting a business: $w_h > p_h - SC$ or $SC > (1-\beta)p_h$.[10] This assumption

[10] Note that adding the option to hire other workers once a firm is started does not affect the return to starting a new firm. This is due to rent dissipation on both labor markets.

implies $SC > c_h$, which reveals the intuition for the existence of firms in this economy, namely that economies of scale exist: a firm is more efficient than the unemployed in creating new jobs. To ensure that starting a firm is attractive for an educated worker who is hit by labor market friction, we assume $w_l < w_h - SC$ or $SC < \beta\ (p_h - p_l)$.[11] Otherwise the new option of starting a business has no value because educated workers prefer to work in a low-skilled job rather than set up a new firm. To summarize, we consider the case where the option to start a firm is attractive to an educated worker hit by labor market frictions: $w_h > p_h - SC > w_l$.[12] All other cases are trivial.

According to our model, starting a firm is attractive for all high-skilled workers who were unable to find high-skilled vacancies in existing firms. Empirical evidence, as in Hamilton (2000), suggests that non-pecuniary aspects of self-employment also matter and that there is heterogeneity in the non-pecuniary benefits of becoming one's own boss. Others, such as Connelly (1992) and Lohmann (2001), argue that females might value increased flexiblity in self-employment more than males, in particular if they have small children. Our model does not explicitly incorporate a non-pecuniary utility from "being one's own boss". Adding a heterogeneous non-pecuniary benefit of starting a firm would be an interesting extension of the model, but it would not change the basic conclusion that reductions in start-up costs will increase the returns to education and thus increase the proportion of the population that acquires education. It might, however, affect the double dividend if the non-pecuniary aspect of a job turned out to be so high for some individuals that the condition $SC > (1 - \beta)p_h$ would only hold for a fraction of the population and fail to hold for others. In such a case, it may be that reduced starting costs actually decrease the number of high-skilled workers who apply for existing vacancies (they immediately start a firm rather than first try the existing firms), in which case existing firms will not necessarily increase their number of high-skilled vacancies when more people become educated and the second dividend disappears.

[11] Workers in our model compare the payoff of starting a new firm to that of entering the low-skilled labor market because this is their only outside option (by construction, they have been unable to find a high-skilled job in an existing firm).

[12] Given that we assume a frictionless low-skilled labor market, the option to start a firm by low-skilled workers is of no importance. In comparing with data for self-employment, as in Blanchflower (2004), where starting a firm is also an option often used by low-skilled workers, it may be argued that the frictionless low-skilled market is a valid assumption if the losses from starting a firm are small (zero) for low-skilled workers (i.e., in our model $\beta p_l \geq p_l - SC_l$, where SC_l denotes the cost of starting a low-skilled firm).

The Value of Starting a New Firm

In terms of our analysis, this new option changes the marginal condition (2) such that, in equilibrium, the following needs to hold:

$$\frac{m((1-Q(z))N, V_h)}{(1-Q(z))N}(w_h - e(z)) + \left(1 - \frac{m((1-Q(z))N, V_h)}{(1-Q(z))N}\right)(p_h - SC - e(z)) = w_l. \quad (4)$$

This reveals the mechanism highlighted in this paper: becoming a high-educated individual is now more attractive owing to the outside option of opening a new firm. This will unequivocally push down the equilibrium level $\widetilde{z}$. This, in turn, will push up the value of a high-skilled vacancy for existing firms, so that more high-skilled vacancies will be created, which will again increase the value of becoming high educated. Hence, $\tilde{V}_h$ will increase. We summarize this result in the following proposition.

Proposition 2. *Giving mismatched educated workers the option of starting a new business leads to a larger share of workers who acquire education and to an increase in high-skilled vacancies over the basic model.*

Proof. The result follows from the preceding proof. By assumption $p_h - SC > \beta p_l$. Hence the $e(z)$ solving equation (4) must be larger than the $e(z)$ solving (2), hence N_h is increasing. That $\widetilde{V}_h$ increases follows from the monotonicity of $\widetilde{V}_h$ with respect to N_h. ■

To study the effects of reduced start-up costs, we consider the comparative statics of a decrease in SC. We proceed by stating the result of the analysis in a proposition.

Proposition 3. *A reduction in start-up costs* (SC) *implies a higher rate of education and more vacancies for high-skilled jobs.*

Proof. The comparative statics yield the following equations:

$$\left[\Delta\widetilde{z}\frac{\partial}{\partial\widetilde{z}} + \Delta\tilde{V}_h\frac{\partial}{\partial\tilde{V}_h}\right]\left[m\left(1, \frac{\tilde{V}_h}{N_h}\right)(w_h - p_l + SC) + p_l - SC - e(\widetilde{z})\right] = \left(1 - m\left(1, \frac{\tilde{V}_h}{N_h}\right)\right)\Delta SC \quad (5)$$

$$\Delta\widetilde{z}\frac{\partial}{\partial\widetilde{z}}m\left(\frac{N_h}{\tilde{V}_h}, 1\right) = -\Delta\tilde{V}_h\frac{\partial}{\partial\tilde{V}_h}m\left(\frac{N_h}{\tilde{V}_h}, 1\right), \quad (6)$$

which immediately reveals signs: since $(\partial/\partial\tilde{V}_h)m(N_h/\tilde{V}_h, 1) < 0$ and $(\partial/\partial\tilde{z})m(N_h/\tilde{V}_h, 1) < 0$, it follows that $\Delta\tilde{V}_h$ and $\Delta\tilde{z}$ have opposite signs. Manipulating the equations further, we obtain

$$\frac{\Delta\tilde{z}}{\Delta SC} = \frac{(1 - m(1, \tilde{V}_h/N_h))}{\left[\frac{\partial m(1,\tilde{V}_h/N_h)}{\partial\tilde{z}} + \frac{-(\partial/\partial\tilde{z})m(N_h/\tilde{V}_h,1)}{(\partial/\partial\tilde{V}_h)m(N_h/\tilde{V}_h,1)}\frac{\partial m(1,\tilde{V}_h/N_h)}{\partial\tilde{V}_h}\right](w_h - p_l + SC) - e'(\tilde{z})} \tag{7}$$

$$\Delta\tilde{V}_h = \Delta\tilde{z}\frac{-(\partial/\partial\tilde{z})m(N_h/\tilde{V}_h, 1)}{(\partial/\partial\tilde{V}_h)m(N_h/\tilde{V}_h, 1)}. \tag{8}$$

Now, in the formula for $\Delta\tilde{z}/\Delta SC$, the terms with $[\partial m(1, \tilde{V}_h/N_h)]/\partial\tilde{z}$ and $e'(\tilde{z})$ are both positive, which shows that $\Delta\tilde{z}/\Delta SC > 0$. The feedback effect via the negative term

$$\frac{-(\partial/\partial\tilde{z})m(N_h/\tilde{V}_h, 1)}{(\partial/\partial\tilde{V}_h)m(N_h/\tilde{V}_h, 1)}\frac{\partial m(1, \tilde{V}_h/N_h)}{\partial\tilde{V}_h}$$

then increases $\Delta\tilde{z}/\Delta SC$ again. ■

The analysis also shows that the first-order effect of the increased profitability of education with the advent of the outside option is amplified by the second-order effect of the increased number of vacancies that firms provide as a reaction to the increase in the number of applicants. The result embodies the matching externality.

IV. Some Empirical Evidence

The main prediction generated by our model is that lower start-up costs increase the number of individuals who opt to become educated.

As an empirical indicator of such human capital formation, we use data on educational enrollment from the UN *World Development Indicators*. These are available for a large cross-section of countries. Data on start-up costs come from two different sources: Porter *et al.* (2000) and Djankov *et al.* (2002). The former asked executives in different countries "whether venture capital was easy to get".[13] The latter constructed an international database that quantified the regulation of entry of new firms. They went

[13] Venture capital in our model makes it easier for educated individuals to set up their own firm. The main role of venture capital in the literature is to lower c_h, i.e., to make it easier for existing firms to create high-skilled vacancies such as by financing R&D activities of old firms.

to considerable lengths to collect national information on the costs of starting a new firm, including the number of procedures, and the time and cost of obtaining legal status. Djankov *et al.* not only checked available written information, but also contacted the relevant government agencies in the countries under study and commissioned independent reports on entry regulation from local law firms. The data on both venture capital and regulation of entry exist only for the year 1999. This is obviously a problem in that our analysis can then only be cross-sectional. Therefore, our empirical analyis can only establish correlations but no ultimate causation, because we are unable to rule out problems like omitted variable bias, etc.

Figure 1 showed the relation between the "ease in obtaining venture capital" and tertiary school enrollment for 58 countries. These indicators have a very high correlation of 0.69. Likewise, the variable "log(days to obtain legal status)" has a very significant negative correlation with tertiary enrollment for 83 countries;[14] see Figure 2. Very similar relations are obtained for secondary school enrollment rates.[15]

Table 1 reports correlations between our two schooling indicators and four different indicators for start-up costs: the venture capital indicator, time needed to obtain legal status, costs associated with obtaining legal status and the number of procedures which are necessary to start a firm. All of these indicators are highly correlated with each other and with school enrollment.

In a further step, we attempted to correlate school enrollment—either in tertiary or secondary education—with our different indicators for start-up costs, using each indicator in turn because of the high correlations among each other. As further control variables we used some available indicators for school enrollment: GDP per head, total public spending on education,[16] the illiteracy rate of adult males, the unemployment rate of youths, and an indicator for the share of urban population in the country. It can be argued

[14] The number of countries in the statistical samples is somewhat smaller due to missing variables problems for some countries (mainly African), especially related to venture capital and high-tech sectors. The main sample consists of: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Czech Rep., Denmark, Dominican Rep., Ecuador, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Korea, Kyrgyz Republic, Latvia, Lithuania, Malaysia, Mexico, Mongolia, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovak Rep., Slovenia, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, UK, U.S., Uruguay, Venezuela and Zimbabwe.

[15] Enrollment rates are gross enrollment rates, i.e., the number of students divided by the relevant population, which might result in enrollment rates of more than 100 percent for secondary education.

[16] See e.g. Winter-Ebmer and Wirz (2002) for the relation between public funding and enrollment in higher education in Europe.

Table 1. *Correlation between start-up indicators and school enrollment*

	Venture capital	Ln(time)	Ln(cost)	Ln(steps)	Secondary enrollment	Tertiary enrollment
Venture capital easy to get	1.0					
Ln(time to obtain legal status)	−0.61	1.0				
Ln(cost to obtain legal status)	−0.55	0.64	1.0			
Ln(number of steps to obtain legal status)	−0.63	0.83	0.64	1.0		
Secondary school enrollment rate	0.69	−0.53	−0.52	−0.45	1.0	
Tertiary school enrollment rate	0.73	−0.56	−0.56	−0.44	0.79	1.0

Note: Correlations including venture capital relate to 48 observations, all others to 66 observations.

that all of these variables have a direct influence on school enrollment. The illiteracy rate of adults takes into account the intergenerational correlation in education enrollment which is well documented in the literature; see Solon (1999). The unemployment rate of youths can be seen as an indicator of the opportunity costs of youth while deciding about further education. A higher share of the population living in urban centers indicates both a general level of development and the availability of schooling institutions. In an effort to capture omitted variables, which might possibly influence venture capital provision and maybe also schooling, we included the share of employment in services as an indicator for employment structure, market capitalization in percent of GDP as an indicator for the development of the capital market at large, as well as the share of high-tech exports as an indicator for technological advance in the country. Table A1 in the Appendix shows data sources and descriptive statistics for all the variables used in the analysis.

OLS results for tertiary enrollment are listed in Table 2 and those for secondary enrollment may be found in Table 3. In both tables we experiment with the four different indicators for start-up regulation or venture capital explained above. A log-linear specificaton is chosen for the start-up regulation variables to allow for non-linearities in a simple way. The results are remarkably similar across specifications. Our indicators for start-up regulation always have the right sign and are statistically significant most of the time. The assessment by executives as to whether "venture capital is easy to get" varies in the data between a low of 1.9 and a high of 6.4. Increasing this assessment by one standard deviation (0.80) would raise tertiary enrollment by nine percentage points, which is rather high. The quantitative effect of registration time is smaller: decreasing the time necessary to

Table 2. *Tertiary school enrollment*

	(1)	(2)	(3)	(4)
Venture capital easy to get	12.012			
	(3.110)**			
Ln(time to obtain legal status)		−6.042		
		(2.025)**		
Ln(cost to obtain legal status)			−4.332	
			(1.678)*	
Ln(number of steps to obtain legal status)				−6.985
				(3.786)
Unemployment rate youths	0.212	0.191	0.199	0.154
	(0.173)	(0.159)	(0.163)	(0.165)
Illiteracy rate male adults	−0.266	−0.157	−0.130	−0.168
	(0.149)	(0.128)	(0.130)	(0.134)
Public expenses for education	−0.693	0.597	0.365	0.538
	(1.171)	(0.972)	(1.031)	(1.080)
Ln(GDP per head)	5.147	8.782	8.273	9.022
	(2.774)	(1.849)**	(1.926)**	(1.934)**
% urban population	0.132	0.072	0.017	0.098
	(0.167)	(0.133)	(0.138)	(0.139)
% of employment in services	0.392	−0.001	0.169	0.038
	(0.210)	(0.147)	(0.156)	(0.153)
Market capitalization in % of GDP	−0.070	−0.036	−0.042	−0.031
	(0.029)*	(0.028)	(0.029)	(0.029)
Share of high-tech exports	0.065	0.010	0.029	0.011
	(0.131)	(0.133)	(0.135)	(0.139)
Observations	48	66	66	
Adjusted R^2	0.64	0.61	0.60	0.58

Note: Standard errors in parentheses.
*Significant at 5%; **significant at 1%.

obtain legal status by one standard deviation of our dataset (27 days) would increase enrollment by 3.8 percentage points, similarly so for registration costs and the number of steps to obtain legal status. The effects of the control variables (unemployment, illiteracy, public expenses, GDP and urban population) always have the anticipated sign, but lack statistical significance in many cases; only the coefficients of GDP and youth unemployment in the case of secondary education are always statistically significant. The indicators for employment structure, market capitalization and technological advance perform less well in terms of explaining educational enrollment.

Robustness Analysis

One potential problem with these results is the possibility of missing confounding variables or the endogeneity of start-up costs. It could be the case that both school enrollment as well as start-up regulation are caused by third

Table 3. *Secondary school enrollment*

	(1)	(2)	(3)	(4)
Venture capital easy to get	12.102			
	(5.271)*			
Ln(time to obtain legal status)		−9.367		
		(2.931)**		
Ln(cost to obtain legal status)			−4.646	
			(2.520)	
Ln(number of steps to obtain legal status)				−12.143
				(5.465)*
Unemployment rate youths	0.613	0.626	0.600	0.576
	(0.293)*	(0.230)**	(0.244)*	(0.238)*
Illiteracy rate male adults	−0.107	−0.048	0.010	−0.070
	(0.253)	(0.185)	(0.195)	(0.194)
Public expenses for education	0.062	0.304	0.431	0.052
	(1.985)	(1.407)	(1.548)	(1.559)
Ln(GDP per head)	11.537	14.432	14.235	14.712
	(4.701)*	(2.677)**	(2.892)**	(2.792)**
% urban population	0.003	0.048	−0.007	0.092
	(0.283)	(0.193)	(0.207)	(0.201)
% of employment in services	0.195	0.391	0.186	0.331
	(0.357)	(0.213)	(0.235)	(0.221)
Market capitalization in % of GDP	−0.076	−0.050	−0.049	−0.045
	(0.048)	(0.040)	(0.044)	(0.042)
Share of high-tech exports	0.009	0.086	0.111	0.084
	(0.222)	(0.193)	(0.203)	(0.201)
Observations	48	66	66	66
Adjusted R^2	0.52	0.60	0.56	0.57

Note: Standard errors in parentheses.
*Significant at 5%; **significant at 1%.

factors such as the climate towards entrepreneurship. Angrist and Krueger (1999) discuss the possibility of checking for exogeneity of a variable by examining situations where the variable should definitely have no impact. In our case, we might assume that start-up costs should have no influence on primary school enrollment, because—according to the model—start-up costs only matter for high-skilled workers. The presence of significant effects of our measures of start-up costs on primary education as well would be cause for concern. Such an "irrelevant" correlation would be a sign that something else is hiding behind this coefficient: most likely the influence of third variables. Table 4 reports results from such regressions, where the dependent variable now is enrollment in primary school. We report only the coefficients for the start-up cost indicators: all indicators are insignificant and show the wrong sign. There is definitively no correlation between start-up costs and primary school enrollment.

In another attempt to deal with potential endogeneity, we instrumented start-up costs by political variables which can be argued to affect start-up

Table 4. *Primary school enrollment*

	(1)	(2)	(3)	(4)
Venture capital easy to get	−1.887			
	(3.167)			
Ln(time to obtain legal status)		2.645		
		(1.957)		
Ln(cost to obtain legal status)			0.860	
			(1.615)	
Ln(number of steps to obtain legal status)				3.295
				(3.530)

Note: Standard errors in parentheses. Regressions also include all variables contained in Table 2.
*Significant at 5%; **significant at 1%.

costs directly but school enrollment only indirectly. The essential reason for this is that political decisions can almost immediately affect start-up costs, but not education enrollment. In the short run, enrollment levels are the result of choices made by students and not current government, which makes the effect of political decisions indirect, at least in the short run. As our instruments we used data on the political system from Botero, Djankov, La Porta, Lopez-de-Silanes and Shleifer (2003) and Djankov *et al.* (2002).[17]

Tables 5 and 6 report our IV estimates for the different start-up indicators.[18] The signs of the coefficients of the instrumented variables are always as expected and fairly similar to the OLS results. The coefficients are of comparable size and seven out the eight relevant coefficients are statistically significant at the 5 percent level. To test for the relevance of our instruments, we included indicators for the goodness of fit of the first-stage regressions, i.e., the marginal R^2 and an F-test for the joint significance of the instruments in the first-stage regression. The explanatory power of the instruments, i.e., the marginal R^2, is relatively high, but the F-values for the instruments are in most cases below 5, which is probably due to the small sample size having given rise to high standard errors. The Sargan test for over-identification fails in some specifications, especially in the case of tertiary enrollment and venture capital (colunm 1 in Table 5). This can be interpreted to imply that at least one of the instruments has a direct effect on tertiary enrollment independent of the effect via venture capital

[17] These include: (1) party affiliation: the percentage of years between 1975 and 1995 during which the party of the chief executive and the largest party in Congress had a leftist orientation; (2) indicators for the origin of the legal system; (3) an indicator for autocracy to describe the "general closedness of political institutions"; and (4) an indicator for property rights.
[18] Details on the instrumentation are given in the Appendix, Table A2.

Table 5. *Tertiary school enrollment—IV estimates*

	(1)	(2)	(3)	(4)
Venture capital easy to get	16.041 (7.227)*			
Ln(time to obtain legal status)		−4.267 (2.180)*		
Ln(cost to obtain legal status)			−5.031 (2.409)*	
Ln(number of steps to obtain legal status)				−7.614 (4.454)
Observations	47	62	62	62
Marginal R^2	0.16	0.28	0.40	0.56
F-test	0.83	2.52	4.47	8.39
Sargan over-identification test	15.19	14.93	14.48	13.34
Prob. >chi^2	0.02	0.02	0.02	0.04

Notes: Standard errors in parentheses. Regressions also include all variables contained in Table 2.
*Significant at 5%; **significant at 1%.
Marginal R^2 reports the increase in R^2 once the instruments are added on top of the other exogenous variables in the first-stage regression.
F-test for joint significance of instruments in the first-stage regression.
Sargan over-identification test (with prob.-value) tests the joint null hypotheses that the instruments are uncorrelated with the error term and the second stage is correctly specified.

and different from the independent effect of the other instruments.[19] The instrumental variable results for secondary school enrollment (columns 3 and 4 in Table 6) are the most supportive of our predictions. All the other IV results are somewhat problematic due to the small sample size and incompatibility of the instruments, even though the point estimates of the coefficients of the instrumented variables are always as expected.

V. Conclusions and Discussion

In this paper we attempt to shed new light on the discussion about start-up costs for new firms. Whereas the standard argument in favor of lower start-up costs is that mismatched workers can then set up their own firm, we argue that lower start-up costs also provide incentives for education. This is because new firms (at least those with expansive potential) are often set up by high-skilled workers. Lower start-up costs therefore not only increase production but also lead to a higher proportion of individuals who choose high-skilled education. In the presence of search frictions, this

[19] This might be due to the fact that—while the venture capital indicator relates to the financial infrastructure of the country—the other three indicators are related to legal circumstances which are more responsive to political and legal factors.

Table 6. *Secondary school enrollment—IV estimates*

	(1)	(2)	(3)	(4)
Venture capital easy to get	21.586 (11.968)*			
Ln(time to obtain legal status)		−8.740 (4.302)*		
Ln(cost to obtain legal status)			−8.442 (4.087)*	
Ln(number of steps to obtain legal status)				−13.025 (6.434)*
Observations	47	62	62	62
Marginal R^2	0.16	0.28	0.40	0.56
F-test	0.83	2.52	4.47	8.39
Sargan over-identification test	6.09	6.65	8.20	7.53
Prob. $>$chi^2	0.41	0.35	0.22	0.27

Notes: Standard errors in parentheses. Regressions also include all variables contained in Table 2.
*Significant at 5%; **significant at 1%.
Marginal R^2 reports the increase in R^2 once the instruments are added on top of the other exogenous variables in the first-stage regression.
F-test for joint significance of instruments in the first-stage regression.
Sargan over-identification test (with prob.-value) tests the joint null hypotheses that the instruments are uncorrelated with the error term and the second stage is correctly specified.

improvement in the skill composition of the labor force can furthermore increase the number of high-skilled vacancies. A corollary is that incumbent firms—which are supposed to lose in general from increased competition—can also gain from reduced start-up costs via the skill-composition effect that reduces the tightness of the job market for high-skilled labor.

We present some preliminary evidence on the effects of start-up costs on enrollment, which basically supports our model. It has to be said, however, that these results rely only on cross-country data, which do not allow us to control for many country-specific influences on school enrollment. This arises from the scarcity of comparable data on start-up costs at this time.

Our results also reflect on the discussion as to whether education actually provides skills or merely serves as a signal of *ex-ante* existing skills. Our theoretical model assumes that education improves the skill level of a worker and has no signaling function. In a signaling model of education, workers have to provide an education certificate to signal their quality; no such signal is needed to be your own boss. Lower start-up costs in a signaling context would therefore reduce the incentive for (*ex-ante*) high-potential individuals to invest in the signal. Then, empirical evidence should reveal that lower set-up costs lead to lower tertiary education rates. Here, the empirical evidence suggests otherwise and hence supports the theory that at least some skill acquisition takes place during education.

Appendix

Table A1. *Descriptive statistics and data sources*

	Source	Mean	Standard deviation
Tertiary enrollment rate	WDI	36.01	19.92
Secondary enrollment rate	WDI	87.15	28.47
Primary enrollment rate	WDI	95.23	7.11
Easiness of venture capital	Porter *et al.*	3.99	0.80
Cost of obtaining legal status, log	Djankov *et al.*	−1.83	1.29
Time to obtain legal status, log	Djankov *et al.*	3.47	0.93
No. of procedures to obtain legal status, log	Djankov *et al.*	2.17	0.53
Youth unemployment rate (15-24 years)	WDI	17.06	10.02
Illiteracy rate, total adult males	WDI	10.66	12.60
Public spending on education in % of GDP	WDI	4.76	1.78
GDP per capita, log	WDI	8.41	1.47
Urban population, % of total	WDI	66.80	18.52
Share of employment in services	WDI	58.16	14.72
Market capitalization in % of GDP	WDI	64.92	77.55
Share of high-tech products in exports	WDI	13.98	14.21
Chief executive's party has center-left orientation, 1975-1995	Botero *et al.*	0.586	0.37
Largest party in Congress has center-left orientation, 1975-1995	Botero *et al.*	0.647	0.36
Legal origin, French	Djankov *et al.*	0.379	0.49
Legal origin, Socialist	Djankov *et al.*	0.227	0.42
Legal origin, Scandinavian	Djankov *et al.*	0.061	0.24
Legal origin, English	Djankov *et al.*	0.257	0.44
Property rights, index (0–1)	Djankov *et al.*	0.713	0.23

Table A2. *First-stage regressions for IV*

	Venture capital	Ln(time)	Ln(cost)	Ln(number of steps)
Chief executive's party has left or center orientation	−0.418	0.269	0.302	0.095
	(0.443)	(0.453)	(0.616)	(0.217)
Legislature has left or center orientation	0.751	−0.115	−0.047	−0.020
	(0.668)	(0.495)	(0.673)	(0.237)
Legal origin: base German				
French	0.123	0.081	−0.739	−0.137
	(0.417)	(0.423)	(0.575)	(0.203)
Socialist	0.030	−0.278	−1.212	−0.400
	(0.568)	(0.490)	(0.667)	(0.235)
Scandinavian	0.213	−0.855	−1.487	−0.731
	(0.592)	(0.559)	(0.760)	(0.268)**
English	0.369	−1.125	−1.749	−0.916
	(0.388)	(0.405)**	(0.551)**	(0.194)**
Property rights index	0.882	−1.211	−1.016	−0.744
	(0.879)	(0.730)	(0.993)	(0.351)*

Notes: Standard errors in parentheses. Regressions also include all variables contained in Table 2.
*Significant at 5%; **significant at 1%.

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